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Farmington, Michigan 48024

**Computer
Graphics**

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Datagrid™ Digitizer Features and Options



**Computer
Graphics**



Introduction

1

The DATAGRID digitizer is a high-precision coordinate-measuring unit that converts graphical data into digital form for both computer and noncomputer applications. It is built with integrated circuits for superior reliability and long service. Its overall flexibility makes possible the incorporation of various output devices and system options without necessitating fundamental design changes — ideal for those who need a multipurpose digitizer. And operation is simple, requiring only a minimum of training for non-technical personnel.

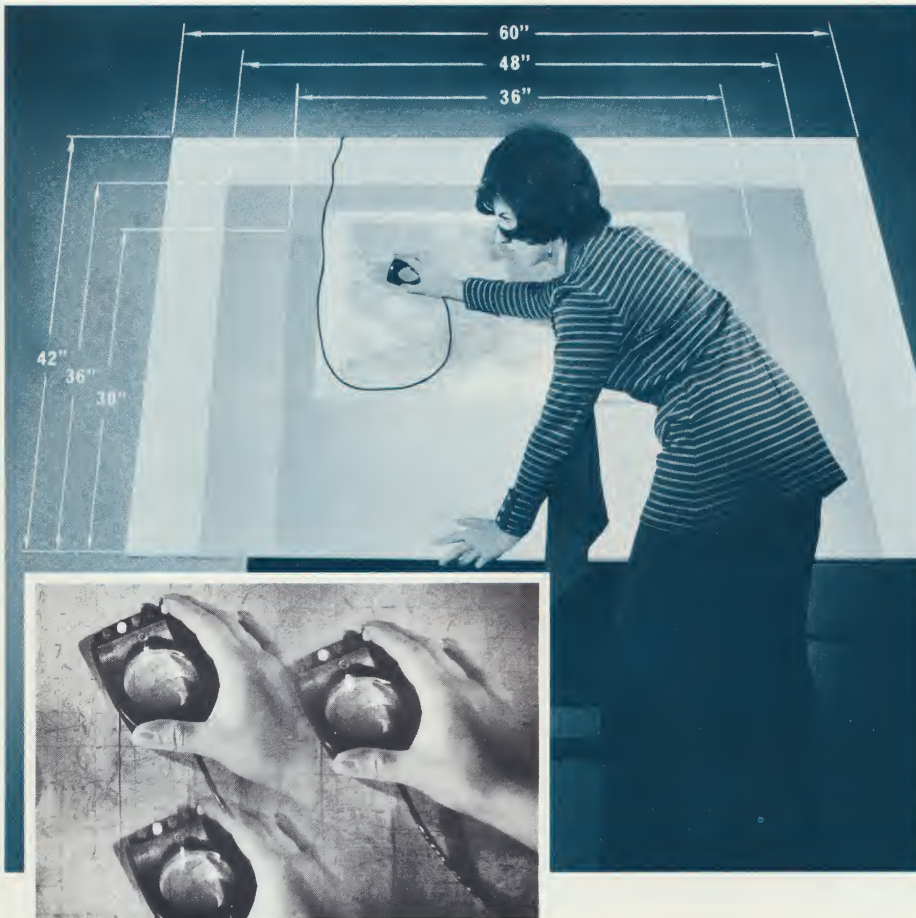
The basic DATAGRID digitizer consists of a work surface with pedestal base, a free-moving cursor, a display and control panel, and an output interface. This all-electronic combination provides a number of advantages not found in conventional mechanical digitizers. Some of these advantages are listed below:

- No mechanical wear or associated drag, interference, or restrictions on manual movements.
- High resolution and accuracy (0.001 inch and ± 0.005 inch, respectively).
- Inherent stability — no adjustments or recalibrations required.
- Cursor tracing speeds up to 300 inches per second with simultaneous two-dimensional measurements.

These design features, together with the many hardware and software options described in this brochure, make the DATAGRID digitizer the best product of its kind on the market today. Any graphic material, including charts, graphs, drawings, photographs, maps, templates, and patterns, can be digitized for virtually any application imaginable. Whether you are a cartographer storing existing map data for future use, an engineer checking design layouts, or a meteorologist correlating weather patterns — the DATAGRID digitizer can satisfy your graphical data reduction needs.

Datagrid Hardware

2



WORK SURFACE

Digitizing Area: 30 x 36, 36 x 48, and 42 x 60 inches.

Material: White formica top; aluminum baseplate structure.

Base: Standard drafting table with tilt and height controls.

CURSOR

Type: Free-moving (no mechanical carriage).

Viewing Area: Two-inch-diameter glass window with precision cross-hair reticle.

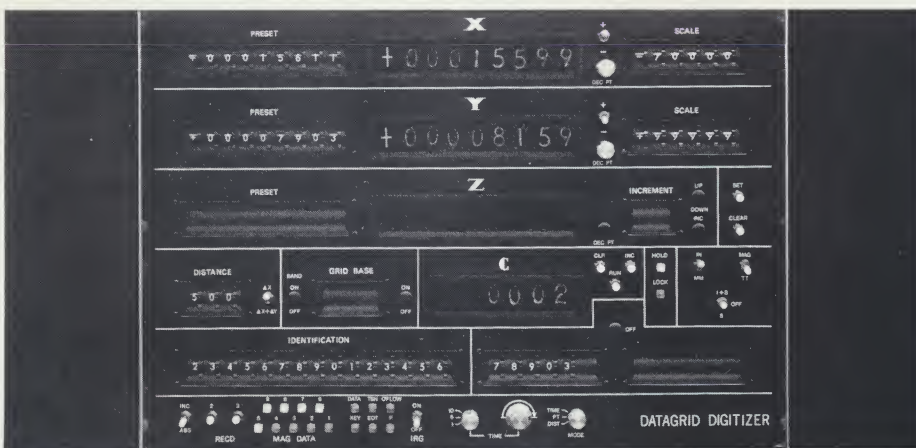
Controls: Three buttons for recording data, one button for establishing the coordinate origin, and one button for coordinate lock-in. Solid-state light indicates recording status.

DISPLAY & CONTROL PANEL

Displays: Five- or eight-digit Nixie tube readout with sign for X and Y axes; Z-axis readout; three- or four-digit event counter display.

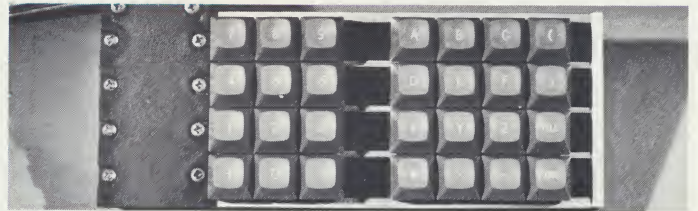
Controls (for all outputs): Coordinate preset thumbwheels for establishing nonzero origin; variable decimal point switch; identification thumbwheels for insertion of constant data in output; incremental/absolute mode switch; event counter controls; duplicate recording switches; common scaling switch with multipliers of 1/10, 1/4, 1/2, and 1; variable scaling thumbwheels for scaling each axis independently up to 2.99999; set/clear buttons; coordinate rotation switch and thumbwheels for aligning the digitizer's axis with that of the graphic material; inch/millimeter conversion switch; grid base thumbwheels and deadband switch.

Controls (additional for magnetic tape output): Stream digitizing with variable distance or variable time controls; magnetic tape data indicators; automatic IRG switch.



SMALL KEYBOARD

Type: Floating (can be placed anywhere on the work surface).
 Number of Keys: Twenty-eight.
 Numeric Keys: Ten (digits 0-9).
 Alphabetic and Symbol Keys: Fourteen (customer specified).
 Control Keys: Four.
 Interlock protection feature included to assure proper data entry.



LARGE KEYBOARD

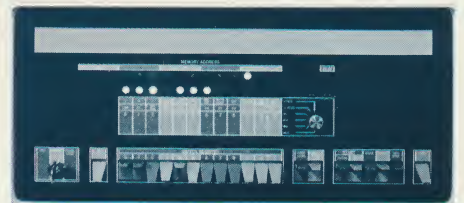
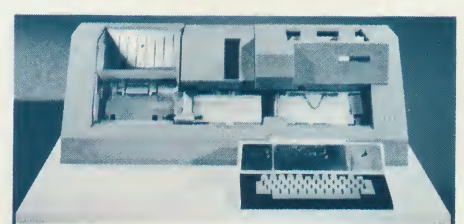
Type: Same as small keyboard.
 Number of Keys: Fifty-five.
 Numeric Keys: Ten (digits 0-9).
 Alphabetic Keys: Twenty-six.
 Symbol Keys: Fifteen (customer specified).
 Control Keys: Four.
 Interlock protection feature included to assure proper data entry.



OUTPUT INTERFACES

Fully buffered interface electronics for the following output devices: high-speed (50-sps) paper tape punch; ASR 33 teletypewriter; IBM-compatible, 7-channel, 556-bpi, 500-sps, or 9-channel, 800-bpi, 700-sps incremental magnetic tape recorder; CRT terminal; IBM 026, 029, or 526 card punch; PDP-8, PDP-11, Nova 800, Nova 1200, IBM 1130, or IBM 1800 computer (others quoted on request); acoustic coupler; and Model 2301 Flexowriter.

Each interface to an off-line recording device includes a 200-position patch panel capable of providing four independent formats. Output codes can be BCD, ASCII, EIA, or EBCDIC.



Datagrid Software

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AUTOMATED DESIGN SOFTWARE

Bendix has developed a software package which does much of the computational work ordinarily performed by designers, including three-dimensional calculations from two- and three-view drawings. The package is in FORTRAN II and requires 19K bytes of storage.

By digitizing pertinent boxes on a "menu" of functions and descriptions, the designer informs the

computer which calculation he wishes to make. The computer informs the designer the sequence of digitizing, the designer digitizes his layout, and the computer responds with the answer.

Standard calculations that can be made with this software include areas, distances, lengths, radii, clearances, slopes, angles, volumes, centroids, and moments of inertia. In addition, the software consists of many subroutines that can serve as basic building blocks for user-

developed programs.

Two views of a typical three-dimensional piping problem are shown in the adjacent figure. The object was to calculate the clearance between pipe 1, 2, 3, 4, and pipe 7, 8, 9, 10, 11. To solve this problem, each pipe was digitized in views XY and XZ. Teletypewriter printout of computer instructions and the answer is shown on the right.

MENU



ADS

XY

XZ

YZ

DISTANCE

ANGLE

LENGTH

RADIUS

AREA

VOLUME

POINT

LINE

CIRCLE

CURVE

PLANE

SURFACE

-

1

2

3

4

5

.

6

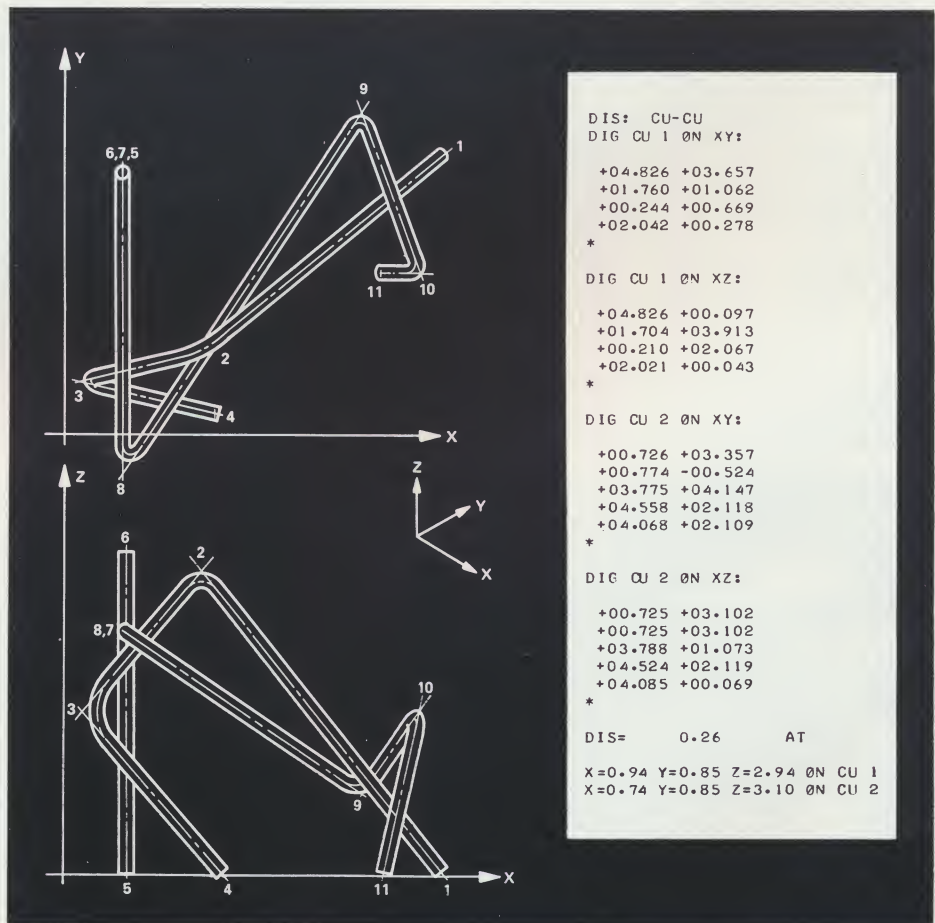
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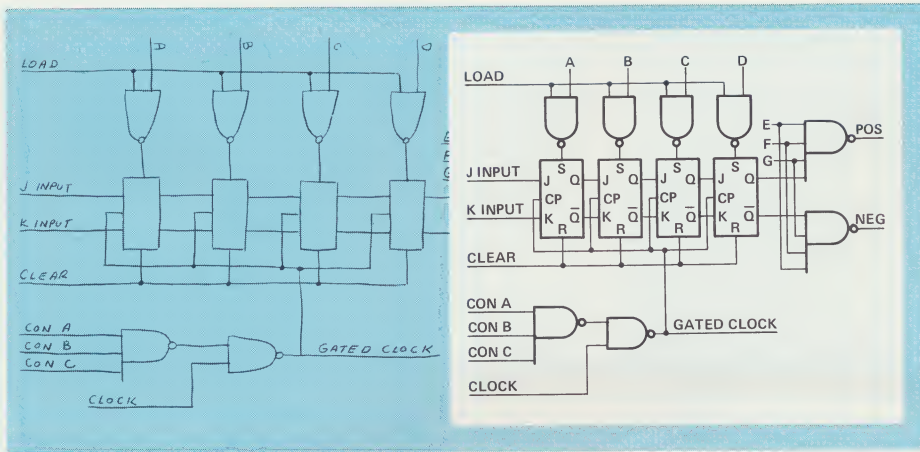
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9

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*

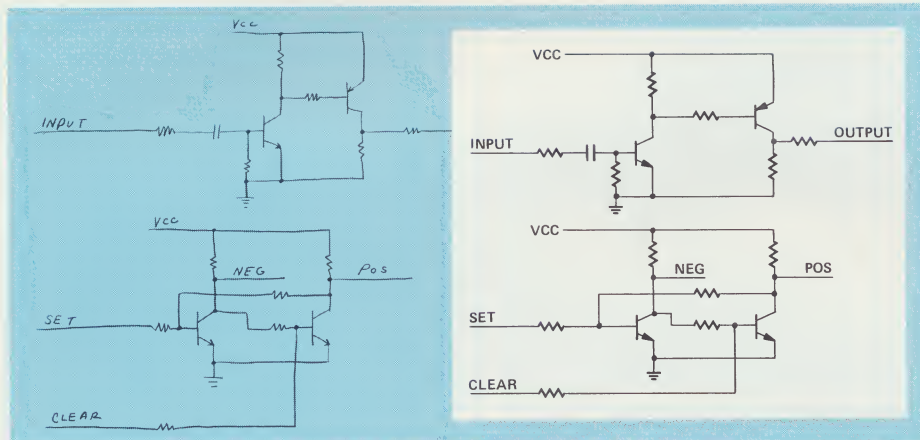




AUTOMATED DRAFTING SOFTWARE

With the DATAGRID digitizer, this software makes possible the transformation of rough sketches into precise drawings containing standard symbols and complex configurations. This software consists of three separate packages for producing tapes to run either an X-Y plotter, a microfilm plotter, or an artwork generator. Full editing capabilities are included in each package for changing and updating drawings.

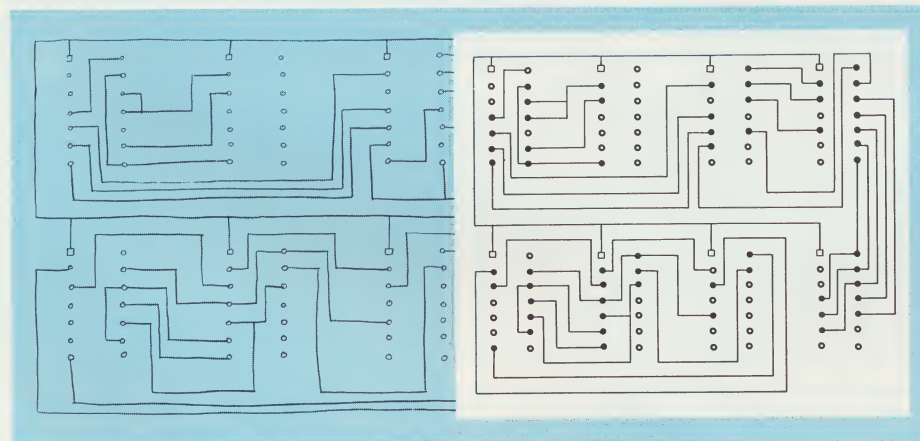
The computer programs contain all of the information necessary to draw alphanumerics, lines, circles, arcs, and user-generated standard symbols. This software can be used for either on-line or off-line DATAGRID digitizer applications.



COORDINATE ADJUSTMENT SOFTWARE

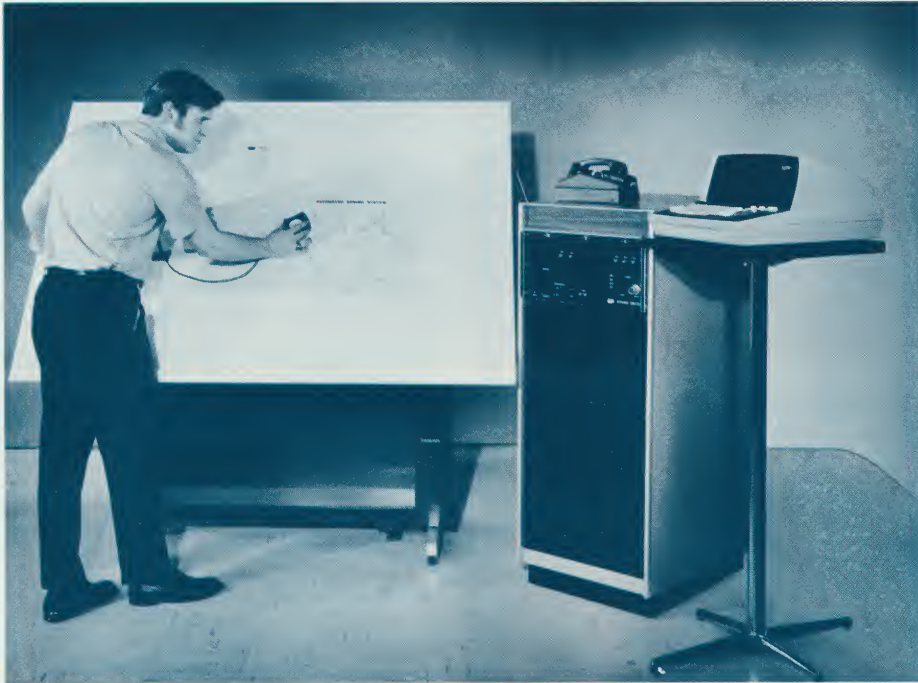
This software converts the digitizer's coordinates to drawing, map, sketch, or chart coordinates. The conversion is done in terms of scale, translation, rotation, grid base, and polar coordinates.

Written in FORTRAN II, this software package can be used for on-line and off-line DATAGRID digitizer applications.



Datagrid Systems

6

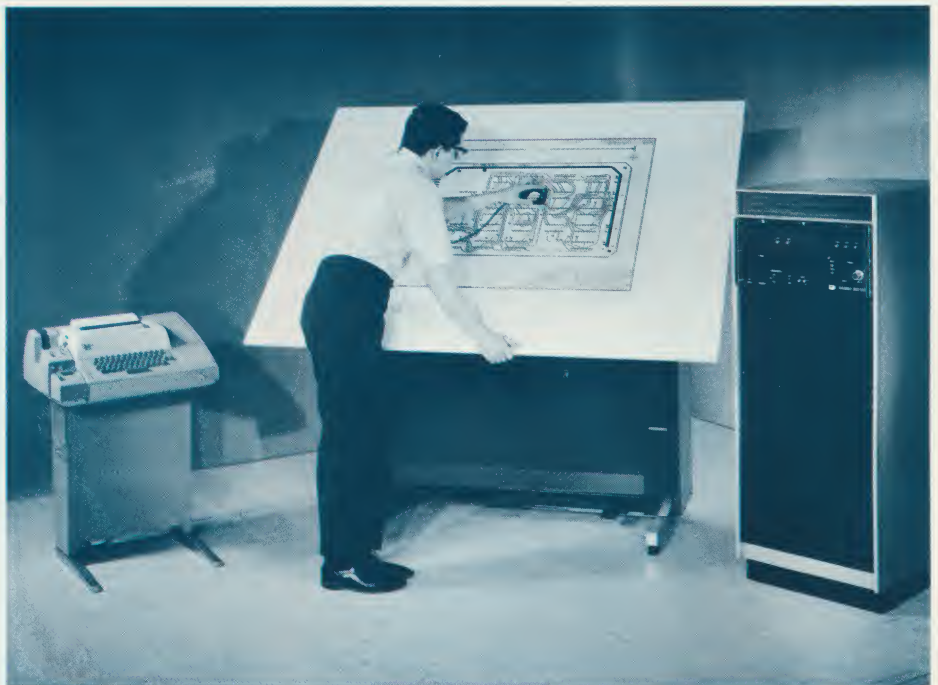


AUTOMATED DESIGN SYSTEM

More software than hardware, the Automated Design System provides the design engineer with a tool for performing routine and complex descriptive geometry calculations through a computer in a matter of seconds. Based upon a unique approach that allows human interaction with the computer through a menu of calculations, the system includes the following hardware: a 42 x 60 inch work surface; a cursor; a five-digit X and Y display; an acoustic coupler; and either (1) a CRT display, or (2) an ASR 33 teletypewriter if hard printout is desired. For software information on this system see page 4.

SYSTEM 70

System 70 is a special DATAGRID configuration for producing programmed N/C artwork plotter control tapes without computer aid. It includes a 42 x 60 inch work surface; a cursor; an ASR 33 teletypewriter; a display and control panel with X and Y axis readout; a three-digit event counter; a scaling switch; grid base thumbwheels; identification thumbwheels; an incremental/absolute mode switch; and an aperture selection switch.



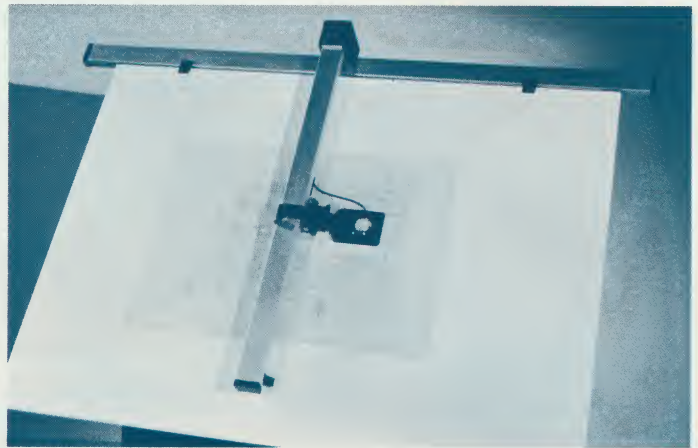


SYSTEM 80

An all-purpose unit, System 80 can convert any graphical map or analog chart data into digital form for computer processing and analysis. In addition to a 42 x 60 inch work surface, this system features a standard cursor; a small keyboard; a five- or eight-digit X and Y axis display; a four-digit event counter; a point/continuous mode switch, a ΔX , $\Delta X + \Delta Y$ increment selector switch; variable-distance increment switches; time-increment switches; and an automatic IRG switch. Standard output is a seven-channel incremental magnetic tape recorder. Options include scaling, preset control, coordinate rotation, and a nine-channel magnetic tape recorder.

Special Options

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Light Table: A 36 x 48 inch tempered glass work surface with variable-intensity backlighting for digitizing films, negatives, mylar, and other translucent materials. Standard drafting table base with tilt control for convenient positioning. Can be used with any output compatible with the DATAGRID digitizer.

X-Y Drafting Assembly: Low-friction aluminum arm with removable standard cursor for applications requiring straight-line digitizing. The arm is supported by a lightweight bar which is easily affixed to the top of a work surface by two wing-nut clamps. This assembly is available in sizes to match any DATAGRID digitizer.

Scribing Cursor: Plastic body with sapphire point in an open two-inch viewing area. Ideally suited for digitizing highly detailed materials such as topographic maps and aerial photographs. Four-button control.

Projection Cursor: White "boomerang" body with inscribed cross hairs for digitizing graphics beamed from an overhead projector. Contains five control buttons and a solid-state light for indicating recording status.

FIRST CLASS
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**Bendix Computer Graphics
23850 Freeway Park Drive
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WARRANTY

Bendix DATAGRID digitizers are warranted to be free from manufacturing defects for a period of one year from the date of delivery. Bendix will provide field service under the warranty for ninety days following installation. After the ninety-day field service period, and during the remainder of the warranty, Bendix will repair or replace at its option all parts determined to be defective under the warranty when they are returned prepaid to Bendix Computer Graphics.

NAME: _____ TITLE: _____

COMPANY: _____

ADDRESS: _____ CITY: _____

STATE: _____ ZIP CODE: _____

TELEPHONE AREA _____ NUMBER _____ EXT. _____

I AM INTERESTED IN:

☐ A DEMONSTRATION OF THE DATAGRID DIGITIZER.

☐ INFORMATION ON BENDIX MICROFILM PLOTTER.

OUR APPLICATION FOR THIS EQUIPMENT IS: _____

WE WILL ☐ WILL NOT ☐ BE PURCHASING DIGITIZERS ☐
THIS YEAR.

COMMENTS _____

For further information, contact:

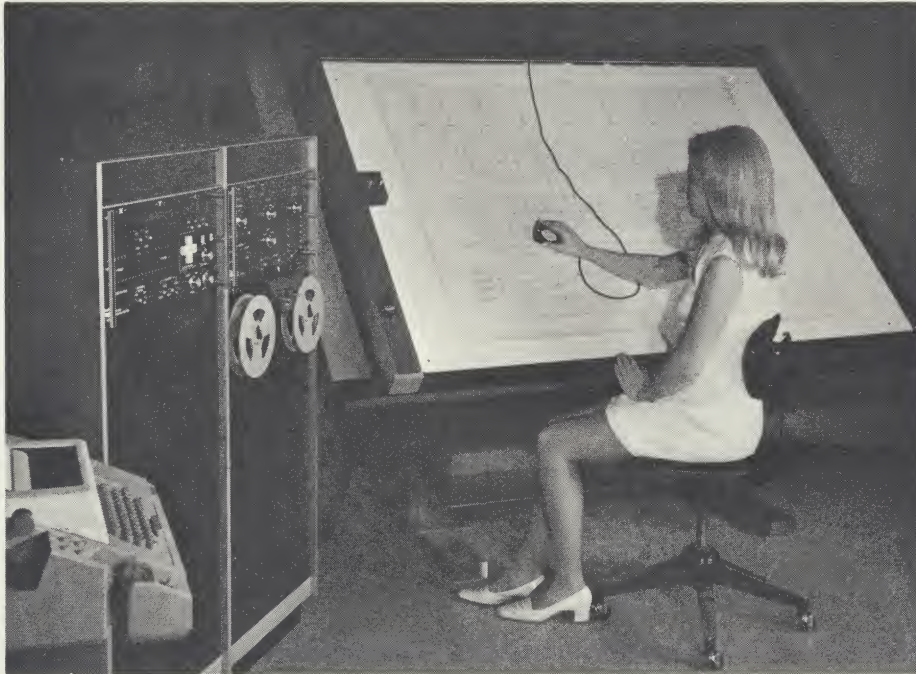
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Telephone: (313) 477-3700

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Bendix Datagrid™ Digitizer Plotter



The Bendix Datagrid digitizer plotter is a product of new design concepts for automated drafting equipment. Accuracy and stability are built into the plotter by means of a Datagrid work surface, which provides electronic position feedback to the drive servos. This direct measurement of pen position eliminates the usual requirements for precision mechanisms and critical alignment.

The Datagrid digitizer plotter is available with punched tape input and a hard-wired controller, or magnetic tape input and a programmable controller. In either case, the controller provides automatic interpolation for vectors and circular arcs. The programmable plotter controller also provides character and symbol generation, scaling, and flexibility for adding other functions.

Optional equipment includes the complete line of Datagrid output recording equipment and other features to utilize the system for digitizing as well as plotting.

- **Built-in Datagrid digitizer accuracy.**
- **No gears, cables, or lead screws.**
- **Quiet, high-speed plotting.**
- **Free-cursor digitizing capability.**
- **Low-profile mechanism provides easy access to work surface.**



Standard Features

Plotting Area	42 x 60 inches.
Servo Drive	DC torque motors with Datagrid digitizer feedback.
Marker Selection	Four pen-lift mechanisms, selectable by tape commands.
Basic Resolution	0.001 inch.
Overall Accuracy	± 0.005 inch.
Repeatability	± 0.002 inch.
Slewing Speed	20 inches per second.
Drawing Speed	Variable speed up to 20 inches per second.
Displays and Controls	Five digits and sign displayed per axis; linear and circular interpolation controls; automatic circular rate control; line and point mode controls; automatic and programmed dwell controls; manual slew and park controls.
Input	IBM-compatible 7-channel or 9-channel magnetic tape; 8-channel paper tape, EIA or ASCII code.
As a Digitizer	Free-moving cursor with specifications as above except repeatability is ± 0.001 inch.

For further information contact:

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Computer Graphics
23850 Freeway Park Drive
Farmington, Michigan 48024
Telephone: (313) 477-3700

Area Sales Offices:

Washington, D.C.; Boston, Mass.;
Bergenfield, N.J.; Detroit, Mich.;
Dallas, Tex.; Houston, Tex.;
Los Angeles, Calif.; San Francisco,
Calif.; Seattle, Wash.

Bendix Programmable Plotter Controller

- **Reads and buffers magnetic tape data**
- **Interprets wide variety of data formats**
- **Scales and interpolates input data**
- **Generates alphanumerics and symbols**



A programmable control unit is now offered as optional equipment for the Bendix Computer Graphics microplotter and Datagrid[†] digitizer plotter. The control unit includes a minicomputer with an 8k byte memory and accepts data from 7- or 9-channel magnetic tape. Programs are provided to accept the commonly used data formats for pen plotters, drafting machines, and computer output microfilers.

For further information, contact The Bendix Corporation, Computer Graphics, 23850 Freeway Park Drive, Farmington, Michigan 48024, Telephone: (313) 477-3700.

[†] A trademark of the Bendix Corporation.

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**Computer
Graphics**

Bendix Microfilm Plotter



**Computer
Graphics**

Your answer to the information explosion

Bendix Microfilm Plotter

- **Direct, Finished Aperture Card Output**
- **High Resolution**
- **Graphic and Alphanumeric Capability**
- **Fast Throughput**
- **Interactive Capability**
- **Low Cost**
- **Wide Range of Options**

Speed and economy—these words mean something when you are talking about the Bendix Microfilm Plotter. Why? Because it's the only COM unit on the market that combines into one automatic operation all of the processes involved in microfilming from digital input. No extraneous equipment is required to develop or mount the exposed film. Just turn the Plotter on, provide data via computer or tape, wait for about a minute, and then lift out an aperture card bearing a precise microfilmed image of your digitized material.

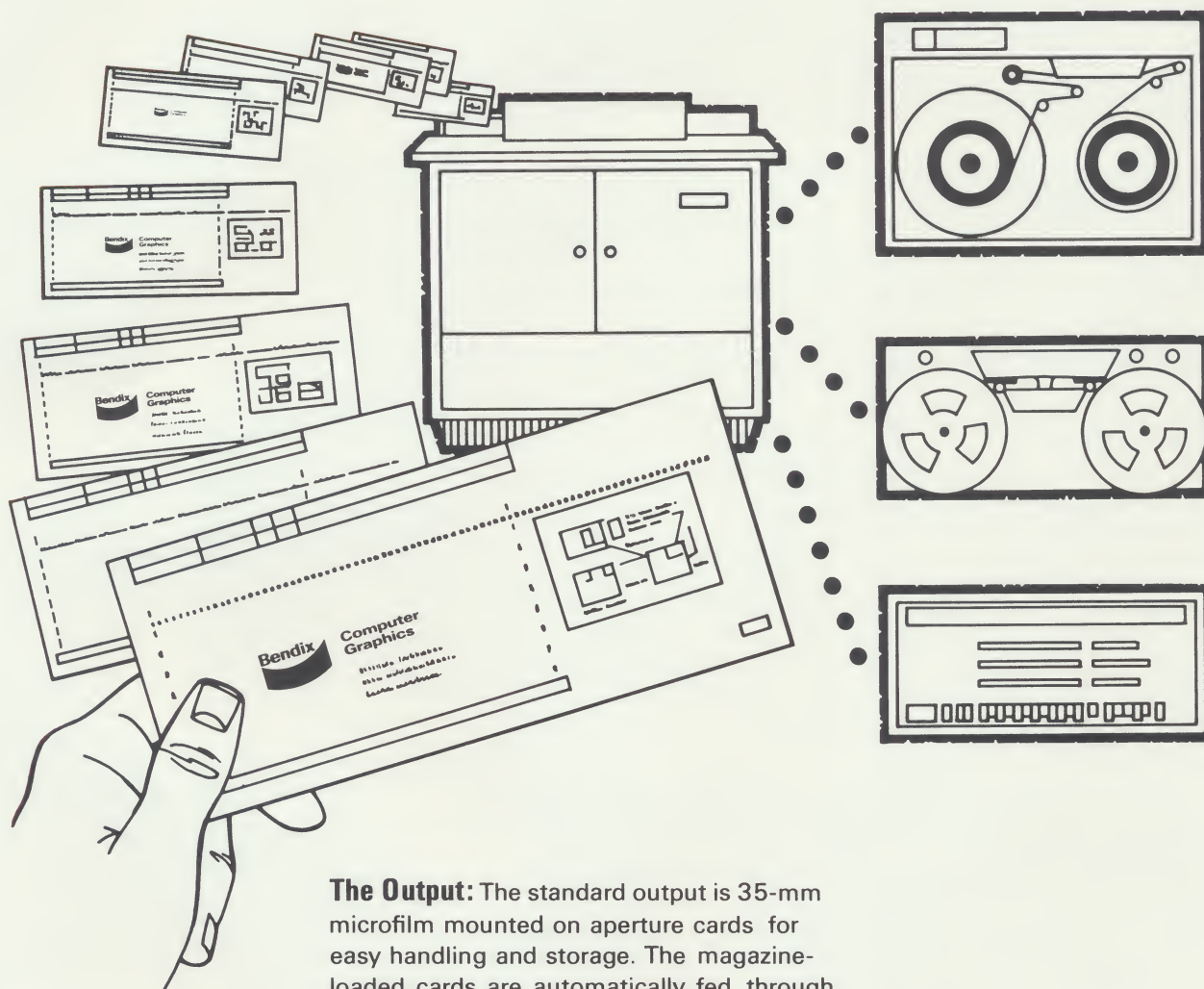
Another reason the Bendix Microfilm Plotter is so fast and economical is its impressive list of quality components. Like the high-resolution, fast-response CRT that converts the input into fully dimensioned, detailed output images. Or like the line and circle interpolator. This feature makes possible the plotting of lines, circles, and arcs without specifying a lot of reference points. For generation of a line, only the end point need be specified; for a circle, only the center and radius; for an arc, only the center, an end point, and the direction. In each case, the intermediate points are automatically generated by the interpolator.

Character generation? The Bendix Microfilm Plotter has it if you want it. This optional feature provides the full range of alphanumerics in two sizes, as well as commonly used punctuation marks and other symbols. And this capability is hard-wired into the Plotter, thus eliminating the need for complicated software. During operation, each text character is called up by a single input character, and the line, circle, and arc elements required to construct the text character are supplied to the interpolator. Either upper- or lower-case letters can be produced at 500 characters/second.

A vector generator option is offered for plotting waveforms, complex curves, or symbols not in the standard character set. This option enables a single input character to specify one of 48 different vectors. A multitude of other options are also available, such as a forms projector for producing like material in volume, a storage CRT for viewing the information being plotted, and roll film output for those who have special applications.

What about software? A complete library of basic utility routines to simplify Plotter usage and to permit direct access to all hardware options is provided in the basic system. Higher level routines, such as those for two-dimensional transformations, scaling, and shifting, are available on an optional basis.

The Input: Digital data can be fed into the Bendix Microfilm Plotter from either (1) seven- or nine-channel magnetic tape, (2) eight-channel paper tape, or (3) an on-line computer.



The Output: The standard output is 35-mm microfilm mounted on aperture cards for easy handling and storage. The magazine-loaded cards are automatically fed through exposure and processing stages. Fixer, developer, and wash solutions are applied under pressure from containers inside the Plotter cabinet.

Major Features

DRAWING AREA *	21.8 x 14.9 inches
ADDRESSABLE POINTS IN THE USABLE FIELD	16,382 x 16,382
RESOLUTION *	0.002 inch
ACCURACY *	±0.85% over the drawing area. Over a 12-inch square, ±0.5%
LINE WIDTH *	Two widths are available: 0.012 and 0.024 inch
LINE TYPES	Dotted, dashed, solid, chained
LINE DRAWING SPEED *	330 inches/second
INPUT	Can be driven by IBM 360 Series computer; magnetic tape; paper tape; (other input interfaces quoted on request)
OUTPUT	Standard output 35-mm aperture cards and monitor display scope. Roll film optional
POWER REQUIREMENTS	110/250 volts, 50/60 hertz
OPTIONS QUOTED ON REQUEST	Roll film camera (either 16-mm or 35-mm); vector generator; character generator; forms projector; storage CRT; high-level software; digitizer; and system integration software
FOR FURTHER INFORMATION CONTACT	Marketing Manager, Bendix Computer Graphics Telephone (313) 477-3700
* Assumes a distortion-free normal enlargement of 15X	
Specifications subject to change without notice	

